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PESTICIDE MONITORING REPORT. DEPARTMENT OF THE ARMY PESTICIDE M--ETC(U)
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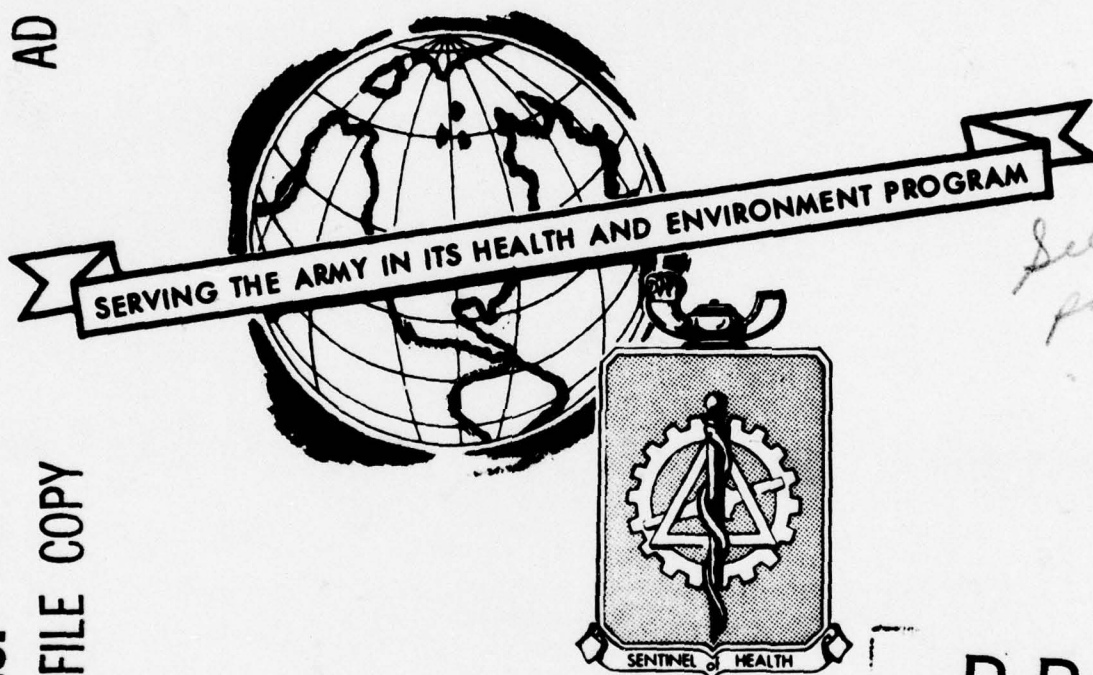
PESTICIDE MONITORING REPORT NO. 44-0143-78
DEPARTMENT OF THE ARMY PESTICIDE MONITORING PROGRAM CONTRAST
OF A 12-INSTALLATION SUBSET OF THE
1975 DA PESTICIDE MONITORING PROGRAM DATA TO THE 34-INSTALLATION DATA

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| Pesticides Monitoring Environment | Sediment Fish Birds | Residues Statistical Analysis Soil |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A 12-installation subset of the 34-installation 1975 DAPMP was evaluated to determine whether or not this 12-installation subset reflects the patterns observed from the 34 installations. The following findings were common in both the 12- and 34-installation data sets: differences in soil stratifications and the differences between top and bottom feeding fish. The differences in sediment stratifications observed in the 34-installation set were not confirmed in the 12-installation subsets. Interactions observed between fish and sediment were observed in both data sets and the transformed soil and sediment data sets. | | |

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U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

Mr. Olds/bb/584-3613

HSE-RP/WP

5 JUN 1978

SUBJECT: Pesticide Monitoring Report No. 44-0143-78, Department of the Army
Pesticide Monitoring Program (DAPMP) Contrast of a 12-Installation
Subset of the 1975 DAPMP Data to the 34-Installation Data

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A summary of the pertinent findings and recommendations of the inclosed report follows.

a. Findings. A 12-installation subset of the 34-installation 1975 DAPMP was evaluated to determine whether or not this 12-installation subset reflects the patterns observed from the 34 installations. The following findings were common in both the 12- and 34-installation data set: differences in soil stratification and the differences between top and bottom feeding fish. The differences in sediment stratifications observed in the 34-installation set were not confirmed in the 12-installation subsets. Interactions observed between fish and sediment were observed in both data sets and the transformed soil and sediment data sets.

b. Recommendations. Recommendations are made to expand the DAPMP to 16 installations to provide a less conservative and statistically more sensitive data base.

FOR THE COMMANDER:

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6 PESTICIDE MONITORING REPORT NO. 44-0143-78
DEPARTMENT OF THE ARMY PESTICIDE MONITORING PROGRAM CONTRAST
OF A 12-INSTALLATION SUBSET OF THE
1975 DA PESTICIDE MONITORING PROGRAM DATA TO THE 34-INSTALLATION DATA.

1. AUTHORITY.

9 Rept. for Jan-Dec 75

- a. AR 40-5, Health and Environment, 25 September 1974.
- b. AR 200-1, Environmental Protection and Enhancement, 20 January 1978.
- c. Public Law 92-516, Federal Environmental Pesticide Control Act of 1972, 21 October 1972, as amended by Public Law 94-140, 28 November 1975.

2. REFERENCES.

a. USAEHA, Pesticide Monitoring Annual Report No. 44-0100-78, Department of the Army Pesticide Program Evaluation of Environmental Samples Collected in Calendar Year 1975, March 1978.

b. USAEHA, Pesticide Monitoring Special Study No. 44-0100-77, Department of the Army Pesticide Monitoring Program, Interim Evaluation of Soil and Sediment Samples Collected in CY 1975 from Fourteen Installations, January - December 1976, National Technical Information Service, ADA 036 998, 1977, 13 pages.

c. USAEHA, Entomological Special Study No. 44-004-74/75, Revised Department of the Army Pesticide Monitoring Program, National Technical Information Service, ADA 004 030, 1975, 38 pages.

3. PURPOSE. To evaluate a 12-installation subset of CY 1975 Department of the Army Pesticide Monitoring Program (DAPMP) data to determine whether or not this subset reflects the patterns observed from the complete 34-installation data set.

4. BACKGROUND.

a. Owing to manpower and physical constraints, the CY 1976 collection guidelines (reference 2c) were modified to include the collection of 12 installations on an annual basis and 11 installations on an alternate year basis for a total of 23 installations each year. This would allow complete monitoring of the 34 installations every 2 years. These same manpower and physical constraints allowed the processing and analysis of only 16 of these 23 installations in CY 1976 and necessitated a further reduction to only 12 installations to comprise the DAPMP for CY 1977. These 12 installations were chosen prior to any statistical evaluation of the data from the 34 installations and were based upon geographical distribution and the availability of field entomologists to assist in sample collection. One

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of the 34 installations from which samples were requested in CY 1975 did not submit samples. This installation was also selected as one of the 12 installations to comprise the revised DAPMP. There are, in fact, only 11 and 33 installations being compared.

b. The 12 installations selected are listed in the Appendix.

c. The statistical procedures used in this report are the same as those used in the 34-installation report, reference 2a.

5. RESULTS AND DISCUSSION. The pesticides analyzed for, the limits of detectability, and the analytical methodology used are the same as those in reference 2a. Based upon the lack of significance shown in the 34-installation data for the rain and runoff soil erosivity factor of the universal soil loss equation,* this parameter is not used for comparative purposes in this report.

a. Soil. Table 1 shows a comparison of all soil samples from the 12 installations versus the 34 installations. The soil samples are divided into three soil groups based upon functions of land use.

(1) Soil Group I is comprised of land use areas where pesticides are stored, mixed, disposed of; sewage treatment areas; and sanitary landfill areas.

(2) Soil Group II is comprised of residential areas, cantonment areas, golf courses, and other recreational areas.

(3) Soil Group III is comprised of out-leased lands and range and training areas.

(4) Comparisons of the 12 installations to the 34 installations based upon the three soil groups are presented in Table 2.

(5) The golf course subset of Soil Group II is contrasted to the overall Group II soils for the 12 and 34 installations in Table 3. The golf course subset is contrasted to Soil Group II minus the golf course data for the 12 and 34 installations in Table 4.

(6) Data based on the various soil site stratifications in reference 2c, are available for comparison between the 12 installations and the 34 installations. The mean pesticide residue concentrations for these sites are compared in Table 5.

* US Department of Agriculture, Control of Water Pollution from Croplands, US Department of Agriculture, ARS, 1975.

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TABLE 1. PESTICIDE RESIDUES (PPM) DETECTED IN SOIL SAMPLES COLLECTED DURING CY 1975 FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

| Number of Samples Pesticide | Consolidated Data | | | |
|--------------------------------|-------------------------|--------|--------------------------|--------|
| | 241 12 Installations | | 697 34 Installations* | |
| | * | Max | * | Max |
| p,p'-DDT | 2.40 | 360.91 | 39.3 | 239.54 |
| o,p'-DDT | 0.46 | 75.26 | 2.39 | 842.4 |
| p,p'-DDE | 0.34 | 22.43 | 0.78 | 206. |
| o,p'-DDE | <0.01 | 0.06 | 0.02 | 8.96 |
| p,p'-DDD | 0.05 | 6.47 | 1.18 | 326.2 |
| o,p'-DDD | 0.01 | 1.75 | 0.18 | 40. |
| oxychlordane | <0.01 | 0.10 | <0.01 | 0.10 |
| chlordane | 7.59 | 683.70 | 15.99 | 4979. |
| trans-chlordane | 0.01 | 0.45 | 0.01 | 0.45 |
| cis-chlordane | 0.01 | 1.36 | 0.01 | 1.41 |
| heptachlor epoxide | 0.01 | 1.64 | 0.01 | 1.64 |
| heptachlor | <0.01 | 0.08 | <0.01 | 0.25 |
| dieldrin | 0.08 | 6.17 | 0.42 | 107. |
| aldrin | nd | | 0.05 | 34.4 |
| endrin | <0.01 | 0.18 | 0.01 | 2.95 |
| lindane | <0.01 | 0.02 | <0.01 | 0.37 |
| methoxychlor | nd | | 0.15 | 89.9 |
| toxaphene | nd | | 0.03 | 21.5 |
| mirex | nd | | <0.01 | 0.05 |
| parathion | nd | | <0.01 | 0.09 |
| malathion | <0.01 | 0.56 | 0.01 | 0.73 |
| diazinon | <0.01 | 0.25 | 0.02 | 9.72 |
| chlorpyrifos | <0.01 | 0.15 | 0.07 | 15.01 |
| No. of Compounds | | 18 | | 25 |

* BHC at .02 ppm and BHC at .06 ppm maximum concentrations were also detected.

nd - not detected

TABLE 2. PESTICIDE RESIDUES (PPM) DETECTED IN SOIL SAMPLES COLLECTED DURING CY 1975 FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

| Number of Samples | Group I | | | Group II | | | Group III | | |
|--------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|-----------|--|--|
| | 37 | 107 | 129 | 385 | 75 | 205 | | | |
| Pesticide | 12 Installations X Max | 34 Installations X Max | 12 Installations X Max | 34 Installations X Max | 12 Installations X Max | 34 Installations X Max | | | |
| p,p'-DDT | 14.56 | 360.91 | 0.31 | 15.62 | 0.57 | 45.60 | | | |
| o,p'-DDT | 2.74 | 75.26 | 0.07 | 5.32 | 0.10 | 7.84 | | | |
| p,p'-DDE | 1.67 | 22.43 | 0.14 | 3.09 | 0.27 | 8.51 | | | |
| o,p'-DDE | nd | 0.09 | <0.01 | 0.06 | <0.01 | 0.23 | | | |
| p,p'-DDD | 0.29 | 6.47 | 0.02 | 1.02 | 0.04 | 2.07 | | | |
| o,p'-DDD | 0.07 | 1.75 | <0.01 | 0.33 | 0.02 | 1.24 | | | |
| oxychlorane | nd | <0.01 | <0.01 | 0.10 | <0.01 | 0.10 | | | |
| chlordane | 48.48 | 683.70 | 0.27 | 7.84 | 0.81 | 49.12 | | | |
| trans-chlordane | <0.01 | 0.02 | 0.01 | 0.45 | <0.01 | 0.45 | | | |
| cis-chlordane | nd | 0.02 | 0.02 | 1.36 | 0.01 | 1.36 | | | |
| heptachlor epoxide | nd | 0.01 | 0.02 | 1.64 | 0.02 | 1.64 | | | |
| heptachlor | nd | <0.01 | <0.01 | 0.08 | <0.01 | 0.25 | | | |
| dieldrin | 0.29 | 6.17 | 0.06 | 3.14 | 0.22 | 19.63 | | | |
| aldrin | nd | 0.33 | nd | <0.01 | <0.01 | 0.89 | | | |
| endrin | <0.01 | 0.18 | nd | 0.13 | <0.01 | 0.13 | | | |
| lindane | <0.01 | 0.01 | <0.01 | 0.02 | <0.01 | 0.02 | | | |
| methoxychlor | nd | 0.91 | nd | 0.03 | 0.03 | 4.65 | | | |
| toxaphene | nd | 0.20 | nd | <0.01 | <0.01 | 1.56 | | | |
| mirex | nd | nd | nd | <0.01 | <0.01 | 0.05 | | | |
| parathion | nd | 0.56 | nd | nd | nd | nd | | | |
| malathion | 0.03 | 0.25 | nd | nd | nd | nd | | | |
| diazinon | 0.01 | 0.13 | nd | nd | nd | nd | | | |
| chlorpyrifos | 0.01 | 0.15 | nd | nd | nd | nd | | | |
| No. of Compounds | 13. | 21. | 14. | 21. | 4. | 13. | | | |

* oBHC at .02 ppm and pBHC at .06 ppm maximum concentrations were also detected.
nd - not detected

* oBHC at .02 ppm and pBHC at .06 ppm maximum concentrations were also detected.
 nd - not detected

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TABLE 3. PESTICIDE RESIDUE DATA (PPM) FOR SOIL GROUP II CONTRASTED WITH SOILS FROM THE GOLF COURSE SUBSET OF THIS GROUP FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

| Number of Samples | Group II | | | Golf Courses | | |
|---------------------|------------------------------|-------------------------------|------------------------------|------------------------------|-------|-------|
| | 129 | 385 | 30 | 88 | | |
| Pesticides | 12 Installations * Max | 34 Installations* * Max | 12 Installations * Max | 34 Installations * Max | | |
| p,p'-DDT | 0.31 | 0.57 | 0.66 | 0.41 | 15.62 | 15.62 |
| o,p'-DDT | 0.07 | 0.10 | 0.20 | 0.10 | 5.32 | 5.32 |
| p,p'-DDE | 0.14 | 0.27 | 0.25 | 0.25 | 3.09 | 8.51 |
| o,p'-DDE | <0.01 | <0.01 | <0.01 | <0.01 | 0.03 | 0.03 |
| p,p'-DDD | 0.02 | 0.04 | 0.02 | 0.02 | 0.19 | 0.56 |
| o,p'-DDD | <0.01 | 0.01 | <0.01 | 0.01 | 0.03 | 0.50 |
| oxychlorane | <0.01 | <0.01 | nd | <0.01 | 0.02 | 0.02 |
| chlordane | 0.27 | 0.81 | 0.73 | 2.40 | 7.84 | 49.12 |
| trans-chlordane | 0.01 | 0.01 | 0.04 | 0.02 | 0.45 | 0.45 |
| cis-chlordane | 0.02 | 0.01 | 0.02 | 0.01 | 0.73 | 0.73 |
| heptachlor epoxide | 0.02 | 0.02 | 0.01 | 0.03 | 0.29 | 0.84 |
| heptachlor | <0.01 | <0.01 | nd | nd | | |
| dieldrin | 0.06 | 0.22 | 0.21 | 0.12 | 3.14 | 3.14 |
| aldrin | nd | <0.01 | nd | nd | | |
| endrin | nd | <0.01 | nd | nd | | |
| lindane | <0.01 | <0.01 | nd | nd | | |
| methoxychlor | nd | 0.03 | nd | nd | | |
| toxaphene | nd | <0.01 | nd | nd | | |
| mirex | nd | <0.01 | nd | nd | | |
| parathion | nd | nd | nd | nd | | |
| malathion | nd | nd | nd | nd | | |
| diazinon | nd | nd | nd | nd | | |
| chlorpyrifos | nd | nd | nd | nd | | |
| Number of Compounds | 14 | 21 | 11 | 12 | | |

* αBHC at .02 ppm and βBHC at .06 ppm maximum concentrations were also detected.
nd - not detected

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TABLE 4. MEAN PESTICIDE RESIDUES (PPM) FOR GOLF COURSES AND SOIL GROUP II MINUS THE GOLF COURSES FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

| | Soil Group II | | | Minus Golf Courses | | |
|------------------|---------------|-----------|----------------|--------------------|------------|----------------|
| | \bar{x} | Max | No. of Samples | \bar{x} | Max | No. of Samples |
| 12 Installations | 0.55 | 7.85 | 99 | 0.73 | 2.14 | 30 |
| | | p,p'-DDT* | | | chlordane* | |
| 34 Installations | 1.74 | 57.73 | 305 | 3.31 | 49.12 | 88 |
| | | p,p'-DDT* | | | chlordane* | |

* Predominate pesticide.

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TABLE 5. MEAN PESTICIDE RESIDUES (PPM) IN SOIL SITES COLLECTED IN CY 1975 FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

| Site | 12 Installations | | | 34 Installations | | |
|---------------------------|------------------|-----------|--------|------------------|-----------|----------|
| | No. Samples | \bar{x} | Max | No. Samples | \bar{x} | Max |
| 400 Pesticide Disposal | 2 | 1.19 | 2.02 | 2 | 1.19 | 2.02 |
| 401 Sewage Treatment | 9 | 6.38 | 47.91 | 25 | 6.94 | 47.91 |
| 402 Sanitary Landfill | 11 | 0.08 | 1.12 | 31 | 0.11 | 1.12 |
| 403 Pesticide Storage | 10 | 209.64 | 808.79 | 27 | 1311.54 | 25332.75 |
| 404 Pesticide Shop | 5 | 72.80 | 171.99 | 19 | 198.86 | 1448.29 |
| 405 Combined Shop/Storage | 0 | | | 3 | 685.68 | 1097.86 |
| 410 Residential | 33 | 0.20 | 1.42 | 99 | 3.40 | 57.73 |
| 411 Cantonment | 33 | 0.69 | 12.02 | 99 | 0.76 | 12.02 |
| 412 Recreational | 33 | 0.78 | 7.04 | 99 | 1.06 | 13.87 |
| 413 Golf Courses | 30 | 2.14 | 29.44 | 88 | 3.31 | 49.12 |
| 421 Grazing/Agricultural | 20 | 0.01 | 0.06 | 50 | 0.11 | 1.21 |
| 422 Range/Training | 55 | 0.03 | 0.43 | 155 | 0.18 | 7.71 |

(7) Statistical Evaluation of Soil Data.

(a) The transformed data described in reference 2a and the analysis of variance shows a significant difference ($p < .01$) between the means of the three soil groups for the 12-installation data; Soil Group I = 1.92, Soil Group II = 0.90, and Soil Group III = 0.22. The difference between the three soil groups is in agreement with the conclusions drawn from the 34 installations.

(b) The hypothesis that golf courses contribute a greater pesticide burden to the environment than do the other sites in Soil Group II is confirmed by the 12-installation analysis of variance. The transformed mean for the nongolf course sites in Group II is 0.78 and the transformed mean for the golf course sites is 1.27. This difference between means is significant at the $p < .05$ level. This finding is also in agreement with the 34-installation data.

b. Sediment.

(1) These data are evaluated and tabulated on the basis of four functional stratifications; i.e., flowing streams at their entrance to the installation, flowing streams at their exit from the installation, streams originating on the installation, and impounded bodies of water. The data from the 12 installations are compared with the data from the 34 installations in Table 6. The data indicate that the 12 installations are a much less sensitive indicator of the sediment profile in that there are fewer pesticides observed and the mean concentrations are lower than those found from 34 installations.

(2) Statistical evaluation of pesticides in sediment by the use of the data transformation reveals that there is no significant difference ($p < .05$) among the four functional stratifications from the 12 installations. This is in direct conflict with the data from the 34 installations where the four functional stratifications were significantly different ($p < .05$). The transformed means for each of the sediment stratifications from the 12 installations are as follows; streams at their entrance = 0.19, streams at their exit = 0.19, streams originating = 0.06, and impounded bodies = 0.16. Although the originating streams show what appears to be a much lower mean pesticide residue concentration, the overall comparison of all four sites does not reflect a significant difference. The lack of comparability between the 12-and 34-installation data is probably accounted for by the decreased sample size from the 12 installations, thus giving decreased statistical sensitivity.

TABLE 6. PESTICIDE RESIDUES (PPM) DETECTED IN SEDIMENT SAMPLES COLLECTED DURING CY 1975 FOR 12 INSTALLATIONS AND 34 INSTA

| Number of Samples | All Sites | | | | Traversing/Entrance | | | | Traversing | |
|-------------------|------------------|------|------------------|-------|---------------------|------|------------------|------|------------------|------|
| | 12 Installations | | 34 Installations | | 12 Installations | | 34 Installations | | 12 Installations | |
| | 127 | | 363 | | 19 | | 58 | | 19 | |
| Pesticides | x | Max | x | Max | x | Max | x | Max | * | Max |
| p,p'-DDT | <0.01 | 0.05 | 0.05 | 8.34 | <0.01 | 0.05 | <0.01 | 0.05 | nd | |
| o,p'-DDT | nd | | <0.01 | 0.76 | nd | | nd | | nd | |
| p,p'-DDE | <0.01 | 0.08 | 0.03 | 6.71 | 0.01 | 0.08 | <0.01 | 0.08 | <0.01 | 0.03 |
| o,p'-DDE | nd | | <0.01 | 1.71 | nd | | nd | | nd | |
| p,p'-DDD | 0.01 | 0.32 | 0.03 | 67.08 | 0.01 | 0.13 | 0.01 | 0.13 | 0.01 | 0.11 |
| o,p'-DDD | <0.01 | 0.05 | 0.06 | 18.25 | <0.01 | 0.03 | <0.01 | 0.03 | <0.01 | 0.03 |
| chlordane | <0.01 | 0.24 | 0.01 | 1.62 | nd | | 0.01 | 0.26 | 0.01 | 0.12 |
| oxychlordane | nd | | <0.01 | 0.06 | nd | | nd | | nd | |
| trans-chlordane | <0.01 | 0.09 | <0.01 | 0.30 | <0.01 | 0.09 | <0.01 | 0.12 | nd | |
| cis-chlordane | <0.01 | 0.05 | 0.01 | 2.53 | <0.01 | 0.05 | <0.01 | 0.05 | nd | |
| dieldrin | <0.01 | 0.02 | <0.01 | 0.10 | <0.01 | 0.02 | <0.01 | 0.02 | nd | |
| aldrin | <0.01 | 0.01 | <0.01 | 0.06 | nd | | <0.01 | 0.02 | nd | |
| No. of Pesticides | 9 | | 12 | | 7 | | 9 | | 4 | |

nd - not detected

975 FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

| Source Installations | Traversing/Exit | | | | Originating | | | | Impounded | | | |
|-------------------------|------------------|-------|------------------|-------|------------------|-------|------------------|-------|------------------|-------|------------------|------|
| | 12 Installations | | 34 Installations | | 12 Installations | | 34 Installations | | 12 Installations | | 34 Installations | |
| | 58 | 19 | 59 | | 17 | 62 | | | 72 | 184 | | |
| | Max | * Max | x | Max | x | Max | x | Max | x | Max | x | Max |
| 1 | 0.05 | nd | <0.01 | 0.04 | nd | 0.14 | 6.96 | <0.01 | 0.05 | 0.06 | 8.34 | |
| nd | | nd | nd | | nd | 0.02 | 0.76 | nd | | <0.01 | 0.20 | |
| 1 | 0.08 | <0.01 | 0.03 | <0.01 | 0.04 | <0.01 | 0.11 | 6.71 | <0.01 | 0.07 | 0.02 | 0.48 |
| nd | | nd | nd | | nd | 0.03 | 1.71 | nd | | <0.01 | 0.06 | |
| 1 | 0.13 | 0.01 | 0.11 | <0.01 | 0.11 | <0.01 | 1.10 | 67.08 | 0.01 | 0.32 | 0.07 | 4.26 |
| 1 | 0.03 | <0.01 | 0.03 | <0.01 | 0.03 | nd | 0.30 | 18.25 | <0.01 | 0.05 | 0.01 | 0.70 |
| 1 | 0.26 | 0.01 | 0.12 | 0.01 | 0.14 | nd | <0.01 | 0.13 | <0.01 | 0.25 | 0.02 | 1.62 |
| nd | | nd | nd | | nd | nd | | | nd | | <0.01 | 0.06 |
| 1 | 0.12 | nd | <0.01 | 0.04 | nd | nd | | | nd | | <0.01 | 0.30 |
| 1 | 0.05 | nd | <0.01 | 0.10 | nd | <0.01 | 0.01 | | nd | | 0.01 | 2.53 |
| 1 | 0.02 | nd | <0.01 | 0.04 | nd | <0.01 | 0.05 | | <0.01 | 0.01 | <0.01 | 0.10 |
| 1 | 0.02 | nd | <0.01 | 0.01 | nd | <0.01 | 0.01 | | <0.01 | 0.01 | <0.01 | 0.06 |
| 9 | | 4 | 9 | | 2 | 9 | | | 7 | 12 | | |

c. Fish.

(1) The fish data are evaluated by the arbitrary classifications of "top feeders" and "bottom feeders." A comparison of mean pesticide residues between the 12 and 34 installations appears in Table 7.

(2) Statistical evaluation of the transformed data from the 12 installations reveals that there is no significant difference between the top and bottom feeders. The transformed mean for the top feeders is 0.87 and the transformed mean for the bottom feeder is 0.82. This difference is not significant at the $p < .05$ level. The 34-installation data also showed no significant difference between the top and bottom feeders.

d. Birds. Owing to a sample loss from a freezer malfunction, there is only one bird sample available from the 12 installations. This makes any comparison between the 12 installations and the 34 installations impossible.

e. Interaction Between Environmental Components. Correlation coefficients "r" were calculated to determine any interactions between the environmental components.

(1) Correlations between fish data and sediment data collected from impounded bodies of water from the 12 installations give an r value of 0.40 which shows no significant correlation. However, the 34-installation comparison for the same data pair did show a significant correlation ($r = 0.57$ $p < .05$).

(2) Correlation between soil data and sediment data using untransformed means for the 12 installations does not show a significant correlation ($p < .05$). This is in agreement with the 34 installations which had no significant correlation ($p < .05$). However, the transformed data for both the 12 installations and the 34 installations do show significant correlations between soil and sediment, $r = 0.72$ ($p < .05$) for the 12 installations and $r = 0.63$ ($p < .05$) for the 34 installations. Correlations between soil data and sediment data using transformed means were not yet completed at the time the 34-installation report (reference 2a) was prepared. At that time, it was postulated that based on a lack of significant correlation between soil and sediment using untransformed data, it was improbable that a significant correlation using transformed data would be found. Surprisingly, however, the converse has turned out to be true, not only for the 34-installation data, but also for the 12-installation subset data.

(3) The paucity of bird data does not allow for any statistical correlations.

6. COMPARISON OF INTERIM ENVIRONMENTAL PESTICIDE CRITERIA. Utilizing the interim criteria levels established in reference 2a; 5.00 ppm for soil, 0.1

TABLE 7. PESTICIDE RESIDUES (PPM) DETECTED IN FISH SAMPLES COLLECTED DURING CY 1975 FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

| Pesticide | All Fish | | | Top Feeders | | | Bottom Feeders | | |
|--------------------|------------------|-------|------|------------------|-------|-------|------------------|-------|-------|
| | 12 Installations | | | 12 Installations | | | 12 Installations | | |
| | 29 | 34 | 108 | 19 | 34 | 59 | 10 | 34 | 49 |
| Number of Samples | Max | Max | Max | Max | Max | Max | Max | Max | Max |
| Pesticide | X | X | X | X | X | X | X | X | X |
| p,p'-DDT | <0.01 | 0.02 | 0.37 | <0.01 | 0.02 | 0.01 | <0.01 | 0.02 | 0.03 |
| o,p'-DDT | nd | nd | 0.03 | nd | 0.76 | 1.46 | 0.08 | 0.35 | 0.31 |
| p,p'-DDE | 0.10 | 0.76 | 1.19 | 0.11 | 0.16 | nd | nd | nd | nd |
| o,p'-DDE | nd | nd | 1.95 | nd | nd | 0.74 | nd | 0.22 | 0.21 |
| p,p'-DDD | 0.08 | 0.54 | 0.45 | 0.10 | 0.10 | 0.14 | 0.05 | 0.02 | 0.03 |
| o,p'-DDD | 0.01 | 0.06 | 0.06 | 0.01 | 0.06 | 0.04 | <0.01 | nd | <0.01 |
| oxychlorodane | nd | nd | 0.06 | nd | nd | nd | nd | nd | 0.04 |
| chlordane | nd | nd | 0.64 | nd | nd | 0.03 | <0.01 | 0.01 | nd |
| trans-chlordane | <0.01 | 0.08 | 0.35 | <0.01 | 0.08 | 0.03 | <0.01 | 0.02 | 0.34 |
| cis-chlordane | <0.01 | 0.02 | 0.02 | nd | <0.01 | 0.04 | <0.01 | 0.02 | 0.04 |
| heptachlor epoxide | <0.01 | <0.01 | 0.08 | <0.01 | <0.01 | 0.02 | nd | <0.01 | 0.02 |
| heptachlor | nd | nd | 0.02 | nd | <0.01 | 2.84 | 0.03 | 0.12 | 0.38 |
| dieldrin | 0.01 | 0.17 | 2.84 | 0.01 | 0.17 | 0.24 | nd | nd | nd |
| aldrin | nd | nd | 0.24 | nd | nd | <0.01 | nd | nd | 0.11 |
| endrin | nd | nd | 0.11 | nd | <0.01 | 0.09 | nd | nd | nd |
| lindane | nd | nd | 0.01 | nd | <0.01 | <0.01 | nd | <0.01 | nd |
| methoxychlor | nd | nd | 0.01 | nd | 0.02 | 1.01 | nd | 0.04 | 1.01 |
| toxaphene | nd | 0.02 | 1.52 | nd | nd | 0.10 | nd | 0.10 | 1.52 |
| mirex | nd | 0.01 | 0.17 | nd | <0.01 | 0.10 | nd | 0.02 | 0.10 |
| parathion | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| malathion | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| diazinon | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| chlorpyrifos | <0.01 | 0.02 | 0.02 | <0.01 | 0.02 | 0.02 | nd | <0.01 | <0.01 |
| No. of Compounds | 9 | 19 | 8 | | | | | | |

nd - not detected

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ppm for sediment, and 1.0 ppm for fish and birds, the histograms (Figures 1 through 8) reveal the following data.

a. The total mean pesticide data for all samples for the 12 installations (Figure 1) shows a similar pattern to the 34-installation data (Figure 2). However, the 12 installations do not reflect those highly contaminated installations from the 34-installation data (those not plotted on the 34-installation histogram).

b. The mean pesticide data for the soil for the 12 installations (Figure 3) show a similar pattern as the histograms for all the samples indicating that the soil is the major contributor of the pesticide burden of those components studied. The 12 installations show that 72.7 percent of the installations fall below the 5.00 ppm criteria level as compared with 54.5 percent for the 34 installations (Figure 4). The absence of the more highly contaminated installations in the 12-installation data is clearly evident.

c. The mean pesticide data for the sediment (Figure 5) show that 90.9 percent of the 12 installations fall below the criteria level of 0.1 ppm, while the 34 installations (Figure 6) have 72.7 percent below this level. Once again, the 12 installations do not reflect the more highly contaminated installations.

d. The mean pesticide data for fish from the 12 installations (Figure 7) have 100 percent of the installations below the 1.00 ppm interim criteria level while the 34 installations have 79.2 percent below this level.

e. The small number of birds from the 12 installations precludes any type of comparison.

7. CONCLUSIONS. The differences observed between the 12-installation data and the 34-installation data reflect, in general, a lower pesticide residue level and a lower pesticide diversity for the 12 installations. These differences are probably accounted for in the decreased sensitivity of the 12-installation data due to sample size and the fact that installations selected did not represent those having higher pesticide concentrations.

a. The soil data reflect a lower residue pattern in the 12 installations as reflected by the percent of installations below the interim criteria level of 5.00 ppm as compared to the percent below for the 34 installations; 72.7 percent versus 54.5 percent, respectively. The pesticide diversity is lower for the 12 installations, 18 pesticides detected, than for the 34 installations, 25 pesticides detected.

(1) The conclusion from the 34-installation data that the three soil groups based on land use patterns are significantly different, is substantiated by the 12-installation data.

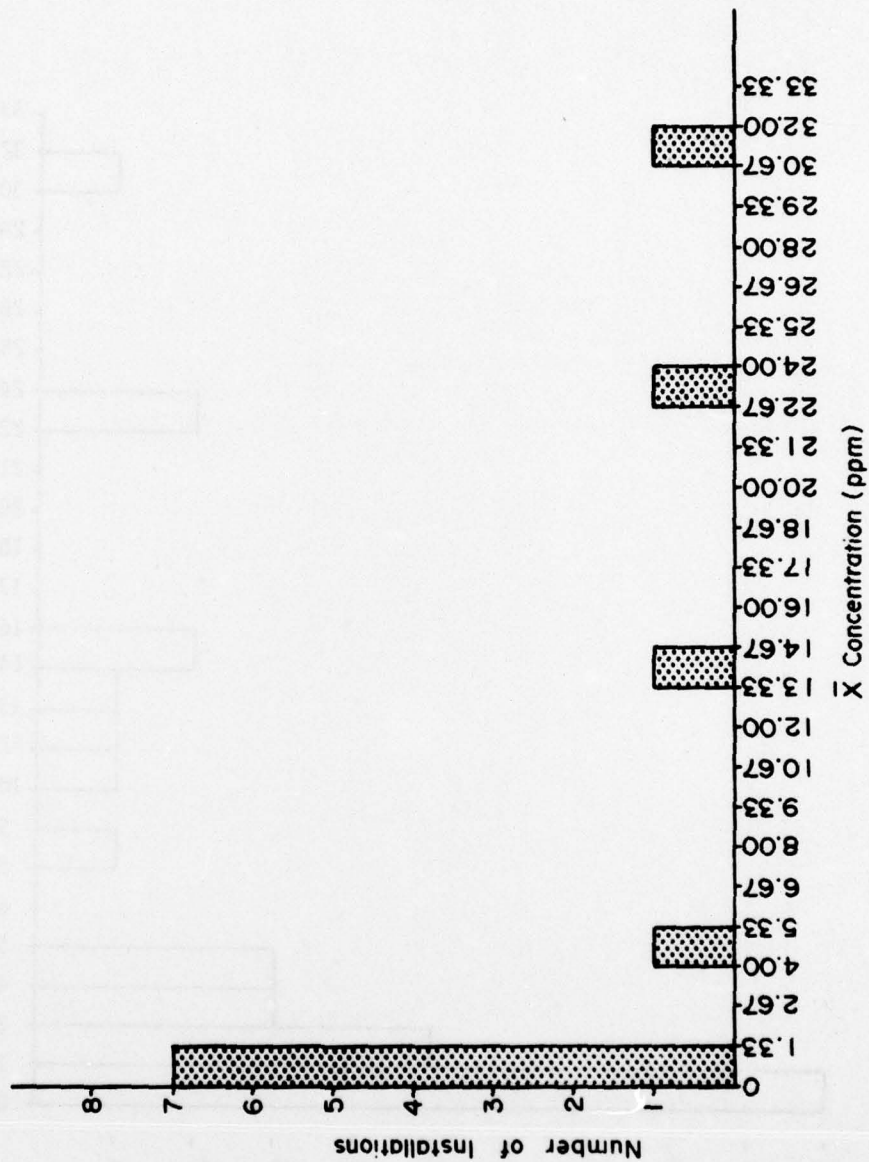
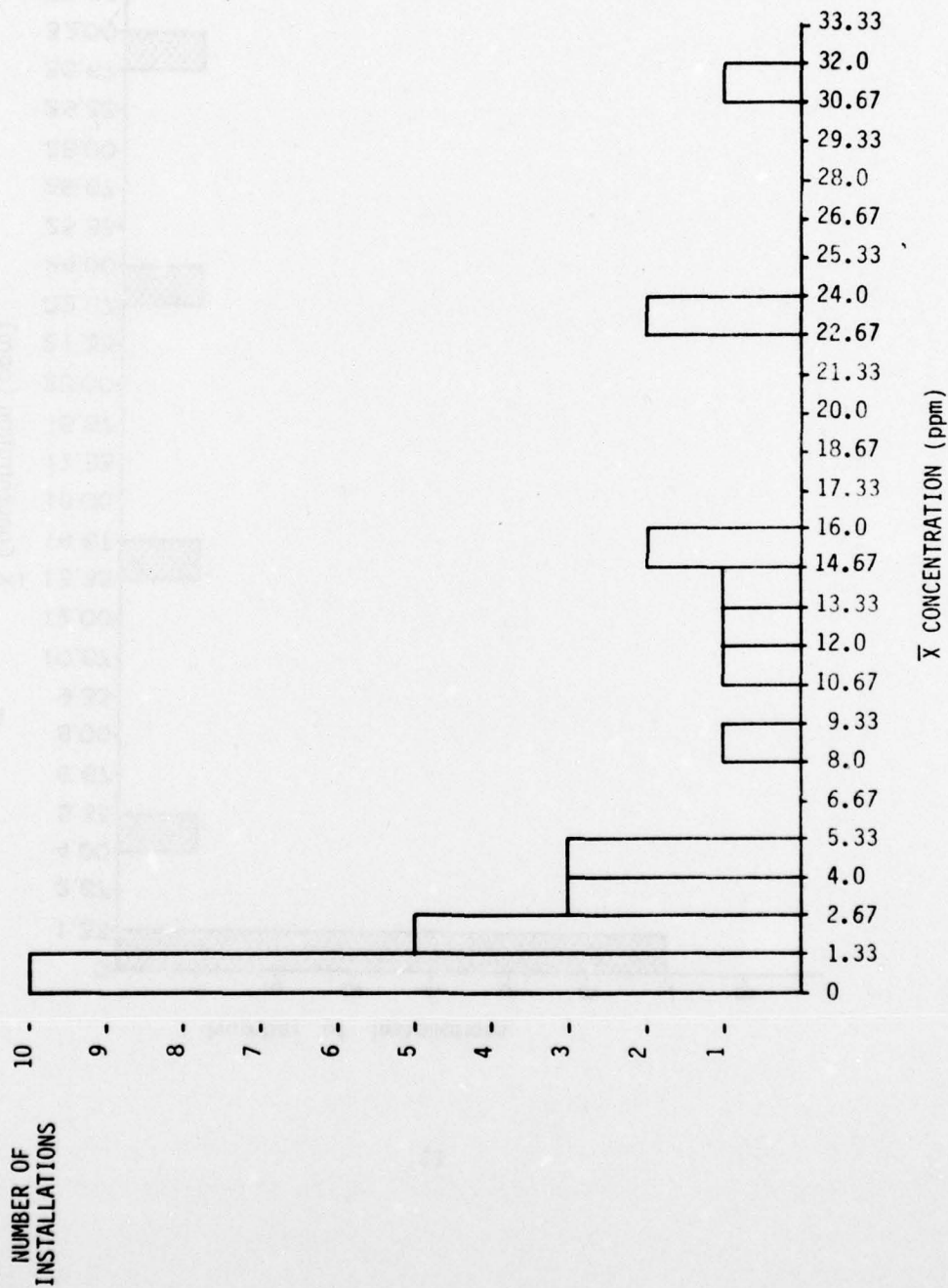


FIGURE 1: DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS FOUND IN ALL SAMPLES, CY 1975 - 12 INSTALLATION DATA

FIGURE 2 - DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS
FOUND IN ALL SAMPLES, CALENDAR YEAR 1975*



* Three installations not plotted \bar{x} concentration, 53.83 ppm, 171.12 ppm, 615.34 ppm

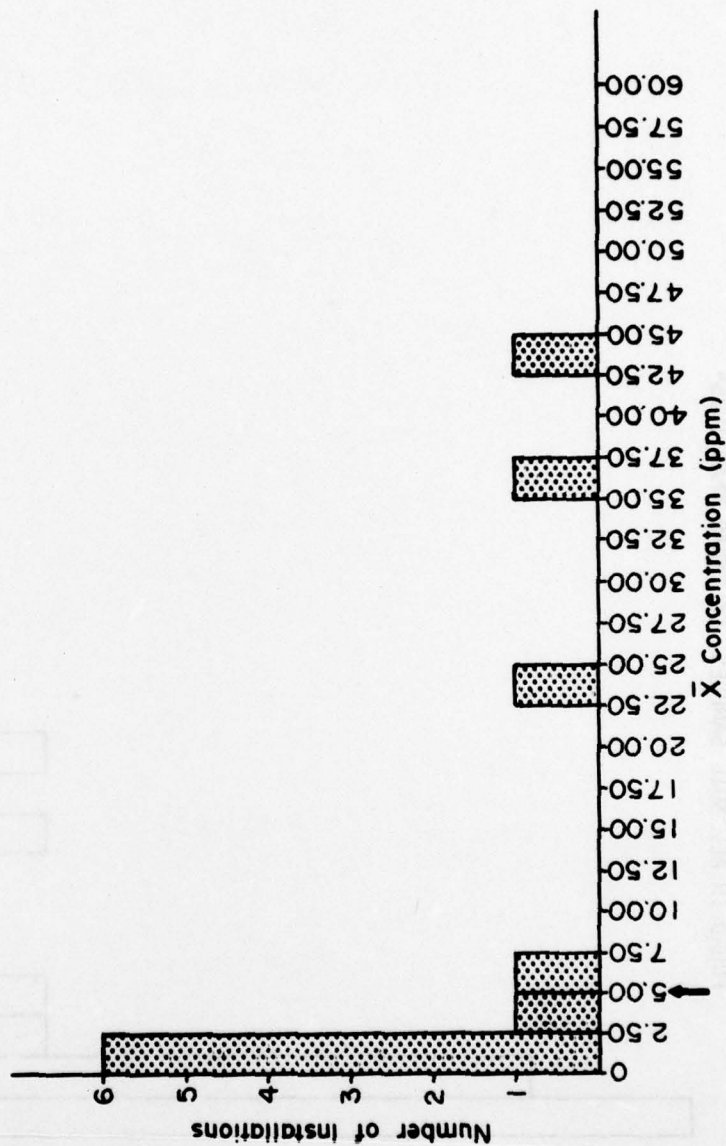
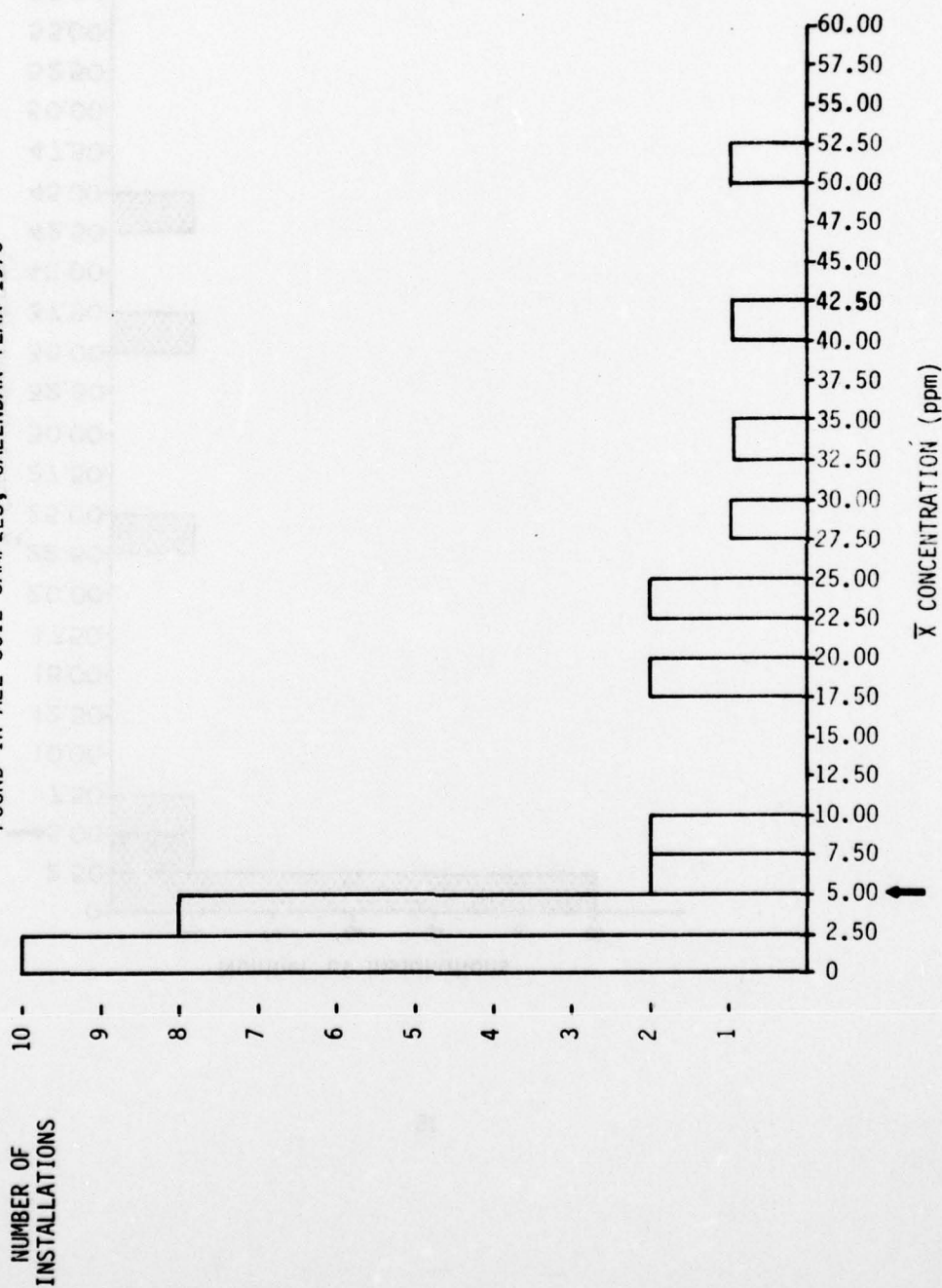


FIGURE 3: DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS FOUND IN ALL SOIL SAMPLES, CY 1975 - 12 INSTALLATION DATA

FIGURE 4 - DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS
FOUND IN ALL SOIL SAMPLES, CALENDAR YEAR 1975*



* Three values not plotted, \bar{X} concentration, 90.42 ppm, 310.80 ppm, 1017.59 ppm

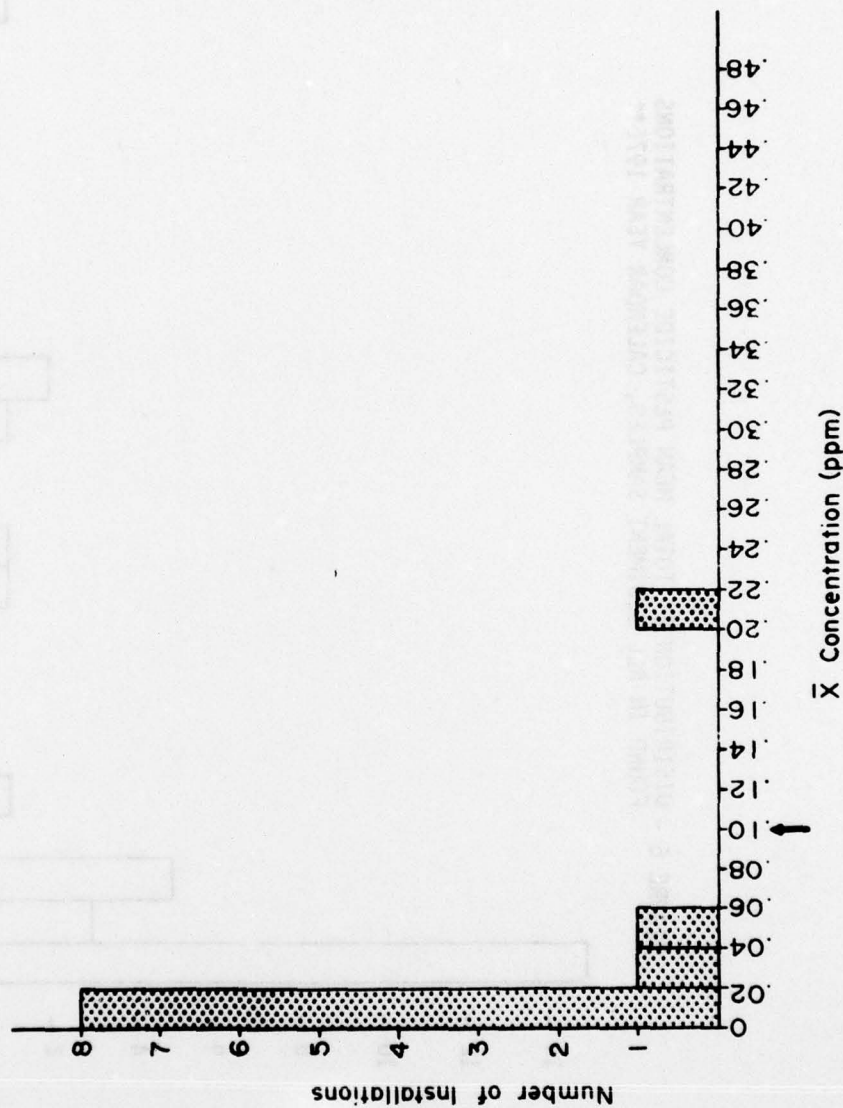
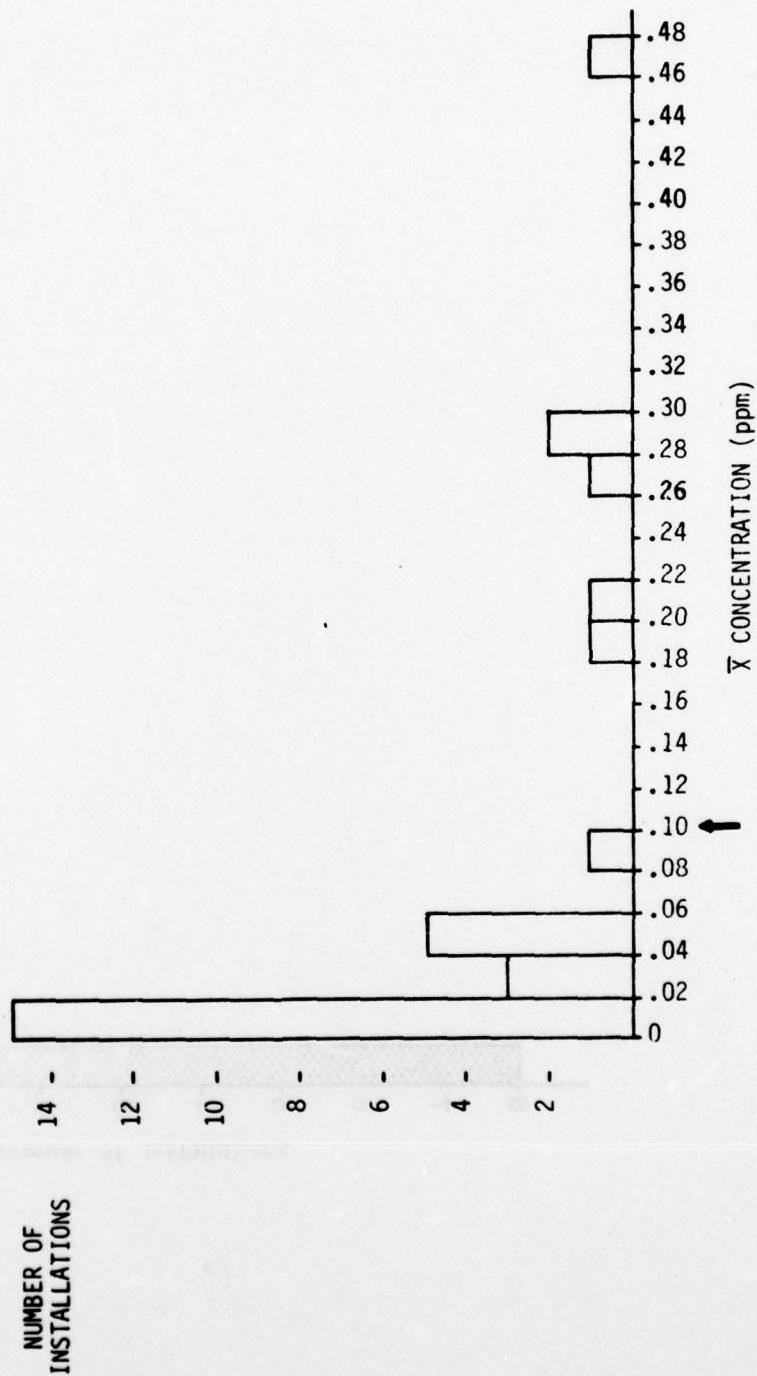


FIGURE 5: DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS FOUND IN ALL SEDIMENT SAMPLES, CY 1975 - 12 INSTALLATION DATA

FIGURE 6 - DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS
FOUND IN ALL SEDIMENT SAMPLES, CALENDAR YEAR 1975*†



* Two values not plotted, \bar{X} concentration, 1.55 ppm, 6.77 ppm
† One installation with no sediment

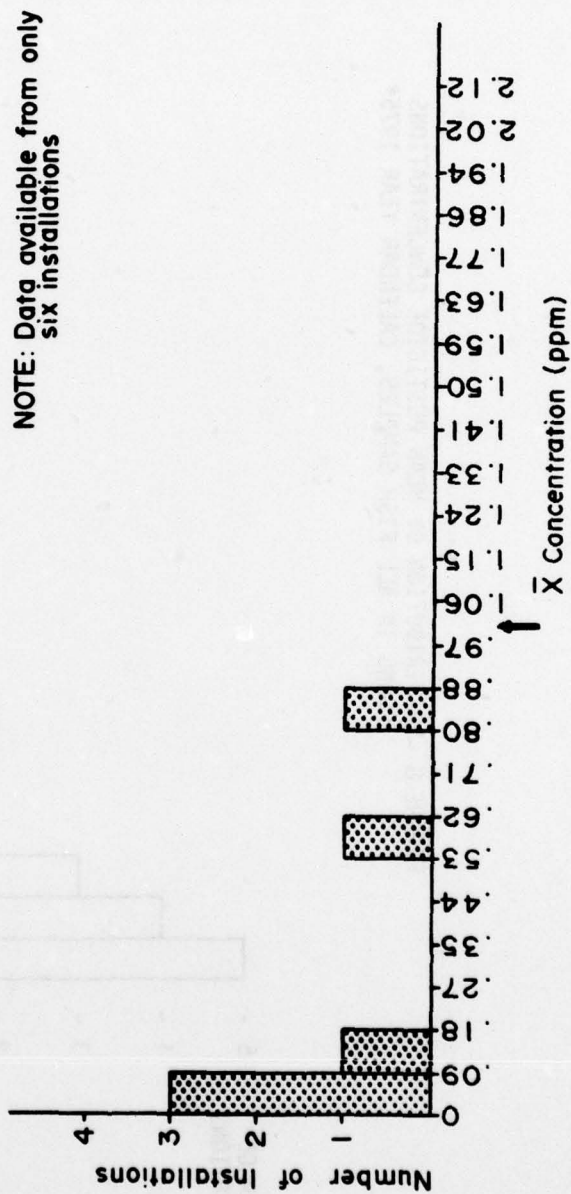
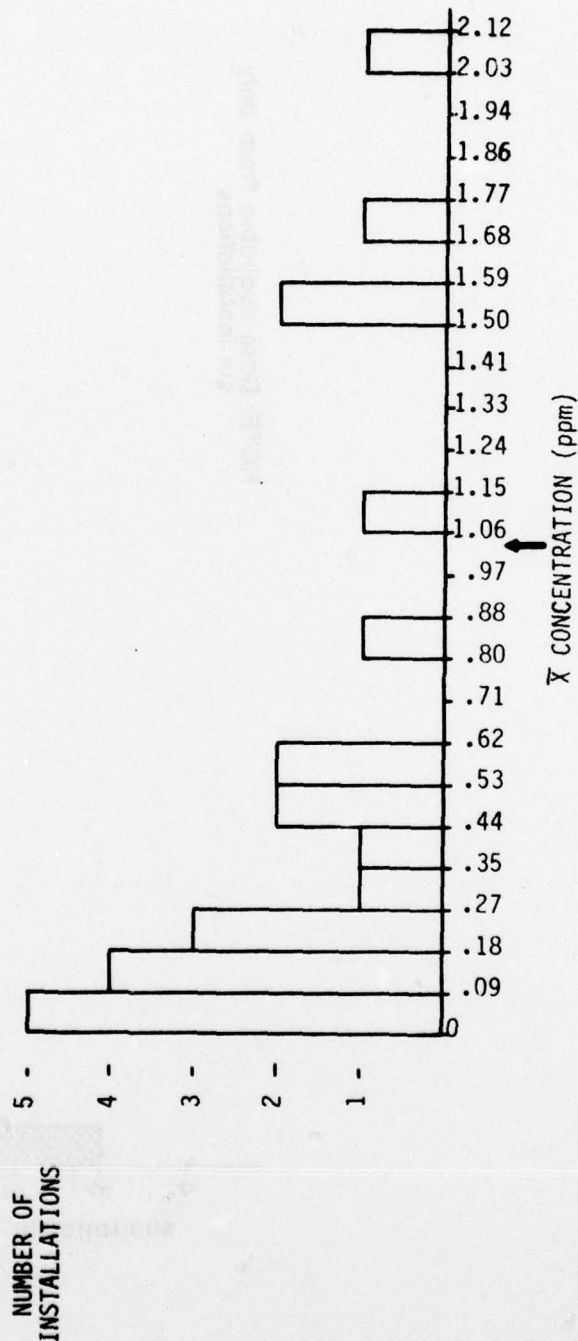


FIGURE 7: DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS FOUND IN ALL FISH SAMPLES, CY 1975 - 12 INSTALLATION DATA

FIGURE 8 - DISTRIBUTION BY MEAN PESTICIDE CONCENTRATIONS
FOUND IN ALL FISH SAMPLES, CALENDAR YEAR 1975*



* Samples available from only 24 installations

(2) The conclusion from the 34-installation data that golf courses are significantly different from the remaining sites in the Group II soils is substantiated by the 12-installation data.

b. The sediment data display the same pattern as the soil: lower pesticide residue concentrations, 90.9 percent of the 12 installations fall below the interim criteria level of 0.10 ppm as compared to the 72.7 percent below for the 34 installations; and fewer residues observed, 9 for the 12 installations and 12 for the 34 installations. The conclusion drawn from the 34-installation data that the four functional stratifications of sediment are significantly different is not substantiated by the 12-installation data.

c. The fish data from 12 installations reflect a lower pesticide residue level (100 percent below the interim criteria level of 1.00 ppm) than the data from the 34 installations (79.2 percent below). The data from the 12-installation subset is in agreement with the 34-installation data regarding the finding of no significant difference between top and bottom feeders.

d. The small number of bird samples from both the 12-installation and 34-installation data does not allow any comparison of data or any conclusions about the data.

e. With regard to interaction between environmental components, the following conclusions can be stated.

(1) Significant correlation between fish and sediment data from the 12-installation subset was not found; this was in contrast to the 34-installation data where a significant correlation was noted.

(2) Both the 12-installation and 34-installation data showed no significant correlation between soil and sediment using untransformed means; however, when transformed means were used in this comparison, both the 12-installation and 34-installation data showed significant correlations.

e. The 12-installation data set appears to be a more conservative and statistically less sensitive estimate of the pesticide impact on the environment than the 34 installations. These 12 installations were chosen prior to the availability of the statistical analysis of the 34 installations and only partially reflect the overall patterns shown by the 34-installation data. However, the necessity for geographical distribution and the availability of field support personnel are factors which must be considered in any selection process.

8. RECOMMENDATIONS. It is recommended that the DAPMP be expanded to 16 installations. The selective addition of four installations would provide a less conservative (i.e., more representative) and more statistically more sensitive data base. These 16 installations would provide essential geographical distribution, necessary field support personnel, and provide a basis for year-to-year comparisons.

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APPENDIX

INSTALLATIONS COMPRISING THE DA PESTICIDE MONITORING PROGRAM
(CY 1977 - PRESENT)
BY MAJOR COMMAND

USACC

Fort Huachuca, AZ

FORSCOM

Fort Bragg, NC
Fort Carson, CO
Fort Devens, MA
Fort Sam Houston, TX
Fort Lewis, WA
Fort McCoy, WI
Fort Ord, CA
Fort Polk, LA

TRADOC

Fort Jackson, SC
Fort Knox, KY
Fort Leonard Wood, MO